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Wasting Away: America's Dysfunctional System of Low-Level radioactive Disposal

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Wasting Away: America's Dysfunctional System of Low-Level Radioactive Waste Disposal

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This paper argues that the current system for disposing of civilian[1] *low-level radioactive waste in the United States is broken, and that large-scale reform is necessary to adequately handle the volume of waste expected from further nuclear decommissioning. Between 1947 and 1980, the federal government had sole responsibility for low-level radioactive waste disposal. The Low-Level Radioactive Waste Policy Act of 1980 upended this system, devolving responsibility for civilian low-level radioactive waste disposal to the states. Devolution has been a disaster.*

For the last thirty years, state governments have been beset by Not In My Back Yard syndrome, as project after project designed to handle additional low-level radioactive waste has been halted by local opposition, leaving the system vulnerable to meddling by state regulators eager to exclude out-of-state waste. This paper discusses the history of this country's system to manage low-level radioactive waste, how it gradually became dysfunctional, and what reforms are necessary to fix it. This paper proposes a two-part solution: first, the integration of Energy Department low-level waste disposal sites into the commercial low-level radioactive waste disposal system, and second, by junking the Low-Level Radioactive Waste Policy Act and returning to the centralized governance structure utilized prior to 1980.

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1. In this paper, I use "civilian waste" and "commercial waste" interchangeably.

"They say atomic radiation can hurt your reproductive organs. My answer is, so can a hockey stick."

-Johnny Carson

I. INTRODUCTION

Radioactive waste is pretty bad for you. But not all radioactive waste is as bad as Hollywood would have you believe. While some types of nuclear waste remain dangerous for millennia, the most common type of radioactive waste, low-level waste, is neither particularly long-lived, nor particularly dangerous. Low-level radioactive waste is a catchall category composed of all nuclear waste that is not spent nuclear fuel, high-level waste, transuranic waste, or uranium mill tailings.[2] In practice, this means that the vast majority of low-level waste is made up of common objects, like protective gear, medical supplies, and other equipment that has been exposed to neutron radiation, or has otherwise become contaminated with radioisotopes.[3] Low-level waste comes from a variety of sources, including universities, hospitals, nuclear power

2. 10 C.F.R. § 62.2 (2013).State-level definitions generally track the NRC definition. *See, e.g.*, VT. STAT. ANN. tit. 10, § 7061(a)(5) (2013); 420 ILL. COMP. STAT. 20/3 (2013).

3. NUCLEAR REGULATORY COMM'N, RADIOACTIVE WASTE: PRODUCTION, STORAGE, DISPOSAL 17 (2002).

plants, and industry. Low-level waste is by far the most common form of radioactive waste.[4]

The radioisotopes involved in low-level waste have relatively short half-lives compared to most other forms of nuclear waste, such that after twenty-five years of storage, only 25 percent of the original radioactivity remains.[5] By comparison, other forms of waste require storage for centuries, or even millennia.[6] The relatively low levels of radioactivity mean that the standard method of disposing of this low-level radioactive waste is to bury the waste in lined, engineered trenches below-grade, which are eventually covered and capped once full.[7] There are four classes of low-level radioactive waste. In order of increasing radioactivity, these are class A, B, C, and greater-than-class C.[8] Class A waste is the least hazardous to human health, and makes up over 95 percent of low-level waste volumes; Class B and C waste makes up the other 5 percent, but contains 90 percent of all low-level radioactivity. Greater-than-class C waste is technically "low-level waste," but its radioactivity levels are so high that it is regulated outside the commercial waste system. As such, greater-than-class C waste is beyond the scope of this paper.

Before 1980, the U.S. Nuclear Regulatory Commission (NRC) and its predecessor, the Atomic Energy Commission (AEC), were responsible for disposal of nuclear waste, subject to the Agreement State process, which permitted individual states to assume day-to-day regulatory responsibility.[9] In 1980, Congress passed the Low Level Radioactive Waste Policy Act (LLRWPA) to completely revamp the disposal of civilian low-level radioactive waste and to devolve responsibility for low-level waste disposal to the states. This came after a series of highly-publicized containment failures permanently shuttered half the nation's low-level waste disposal facilities, and after a near-revolt by the three states that hosted the remaining disposal sites.[10] The LLRWPA was modeled on a proposal developed by the National

4. EDWARD L. GERSHEY, ROBERT C. KLEIN, ESMERALDA PARTY & AMY WILKERSON, LOW-LEVEL RADIOACTIVE WASTE: FROM CRADLE TO GRAVE 12 (1990).

5. S.C. DEP'T. OF HEALTH & ENVTL. CONTROL, COMMERCIAL LOW-LEVEL RADIOACTIVE WASTE DISPOSAL IN SOUTH CAROLINA 6 (2007).

6. NUCLEAR REGULATORY COMM'N, *supra* note 3, at 8.

7. NUCLEAR REGULATORY COMM'N ADVISORY COMM. ON NUCLEAR WASTE, NUREG-1853, HISTORY AND FRAMEWORK OF COMMERCIAL LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT IN THE UNITED STATES 33 (2007).

8. These standards are defined more specifically at 10 C.F.R. § 61.

9. NUCLEAR REGULATORY COMM'N ADVISORY COMM. ON NUCLEAR WASTE, *supra* note 7, at 1. As of this writing, NRC's website currently lists 37 Agreement States.

10. Jane Chuang, *Who Should Win the Garbage Wars? Lessons from the Low-Level Radioactive Waste Policy Act*, 72 FORDHAM L. REV. 2403, 2407 (2004).

Governors Association.[11] Under the LLRWPA, the federal government retained responsibility for disposal of low-level radioactive waste associated with the Department of Energy, Navy vessel decommissioning, the nuclear weapons program, and Greater-than-Class-C low-level waste.[12]

The key component of the LLRWPA was a provision permitting states to arrange themselves into "interstate compacts," which are voluntary associations of state governments that would regulate low-level waste disposal within the compact and permit the exclusion of radioactive waste from outside the compact.[13] At the time, it was believed that these voluntary associations would provide sufficient encouragement for state governments to band together and construct new disposal capacity, with a deadline of January 1, 1986.[14] This did not happen.

As it occurred, the majority of states ended up joining compacts, but by 1983 it was clear that no new disposal capacity would be constructed by the Congressionally-mandated deadline, if at all.[15] As such, the LLRWPA was amended in 1985, resetting the statutory deadline, but also putting teeth in the legislation; any state that failed to provide for disposal capacity by January 1, 1993, would be required, among other things,[16] to take title to any low-level waste generated within its borders and "be liable for all damages directly or indirectly incurred by [the generator or owner of the waste] as a consequence of the failure of the State to take possession."[17]

This "take-title" provision, which was passed into law and signed by President Reagan, led to two results. First, the states began to develop their disposal sites in earnest, but only one site actually opened—and that site was developed commercially, from outside the compact system.[18] Second, a flurry of litigation entered the courts, spearheaded by the

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11. RICHARD B. STEWART & JANE B. STEWART, FUEL CYCLE TO NOWHERE: U.S. LAW & POLICY ON NUCLEAR WASTE 259 (2011).

12. 42 U.S.C. § 2021c(b)(1) (2013).

13. NUCLEAR REGULATORY COMM'N ADVISORY COMM. ON NUCLEAR WASTE, *supra* note 7, at 16.

14. *Id.* at 16 n.22.

15. U.S. GEN. ACCOUNTING OFFICE, REGIONAL LOW-LEVEL RADIOACTIVE WASTE DISPOSAL SITES—PROGRESS BEING MADE BUT NEW SITES WILL PROBABLY NOT BE READY BY 1986 15 (1983).

16. The other incentives provided for by the 1985 Amendments were monetary. *See* Low-Level Radioactive Waste Policy Amendments Act of 1985, 42 U.S.C. §§ 2021b-2021j (2012).

17. 42 U.S.C. § 2021e(d)(2)(C) (2013).

18. This is the Class A waste facility at Clive, Utah, which exists more-or-less outside the compact system. NUCLEAR REGULATORY COMM'N ADVISORY COMM. ON NUCLEAR WASTE, *supra* note 7, at 23.

communities identified to host the disposal sites. Specifically, the State of New York, which had not joined a compact, and the two rural New York counties that were identified to host the New York disposal site, sought to hold unconstitutional the take-title provision and the monetary penalties provided for by the 1985 Amendments.[19] The case, *New York v. United States,* reached the U.S. Supreme Court in 1992. The Court used this historic opportunity to create landmark Tenth Amendment jurisprudence and completely defang the LLRWPA.[20]

With the take-title provision gone, the states soon lost any interest in providing for their own disposal facilities. Civilian low-level waste disposal languished in limbo for twenty years, as only three facilities remained open between 1992 and 2012—two from the AEC era (Richland, Washington and Barnwell, South Carolina), and the new Clive, Utah, facility, which was constructed outside the compact system and licensed in 1991.[21] (Beatty, located near the Nevada Test Site, had been closed by executive order of the Governor of Nevada in the meantime.) Because of the uncertainty surrounding their future availability, these facilities proved to be barely adequate to handle the nation's low-level waste. Richland closed to out-of-compact waste as soon as possible. Barnwell, for years the only place that most states could legally dispose of Class B and C waste, was in constant danger of being closed to out-of-compact waste. Barnwell later closed to out-of-compact waste between 1994 and 1995,[22] and closed to out-of-compact waste permanently in 2008.[23] Clive was only licensed to handle Class A waste—and an attempt to permit Class B and C waste at Clive was rejected by the Utah Legislature.[24] Clive is actually required to accept wastes from all sources, under the Supreme Court's ruling in *Philadelphia v. New Jersey,* which held that states are forbidden from excluding waste based on its source, barring an explicit grant of Congressional authority like the LLRWPA.[25] One new regional disposal facility, located at Andrews, Texas, opened in 2012, but that regional

19. New York v. United States, 505 U.S. 144, 154 (1992).

20. *Id.* at 176-77.

21. NUCLEAR REGULATORY COMM'N ADVISORY COMM. ON NUCLEAR WASTE, *supra* note 7, at 23. It is uncertain just how much authority the Northwest Compact has over the Clive facility at present; litigation is ongoing on the subject as Energysolutions, the operator of Clive, seeks to import waste from other sources. *See* Energysolutions v. Utah, 625 F. 3d 1261 (10th Cir. 2010).

22. S.C. DEP'T. OF HEALTH & ENVTL. CONTROL, *supra* 5, at 1.

23. N.C. RADIATION PROT. COMM'N, LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT IN NORTH CAROLINA 5 (2008).

24. UTAH OFFICE OF THE LEGISLATIVE AUDITOR GEN., PERFORMANCE AUDIT OF THE DEPARTMENT OF RADIATION CONTROL 6 (2012); UTAH CODE ANN. § 19-3-103.7 (West 2013).

25. City of Philadelphia v. New Jersey, 437 U.S. 617 (1978); *see also Energysolutions*, 625 F.3d 1261 (confirming that the Clive facility existed outside the compact system).

disposal facility required two decades of consistent effort and a gerrymandered compact to construct.[26]

The failure of the compact system to produce a workable low-level waste disposal regime is evident from the numbers: in 1980, six geographically contiguous regional compacts, covering all fifty states, were envisioned, each with its own regional disposal facility for low-level waste, incorporating the three old AEC-era disposal facilities into the system.[27] As of this writing, there are currently ten compacts covering forty states. Only three of these compacts currently have a designated regional disposal facility. In short, the nation's low-level radioactive waste disposal system looks nothing like what was envisioned in 1980, and is ridden with dysfunction and infighting.

II. A HISTORY OF LOW-LEVEL RADIOACTIVE WASTE DISPOSAL IN THE UNITED STATES

A. The AEC Era

In 1947, with the Atomic Age only two years old, Congress established the Atomic Energy Commission (AEC) to assume control of the nation's nuclear waste. Disposal of low-level nuclear waste was a problem from the beginning. In the 1950s, the AEC initially dealt with low-level waste by putting it into cement weighted 55-gallon steel drums, then dumping those drums into the ocean.[28] This was never intended to be a permanent solution; the high cost of marine low-level waste disposal, combined with environmental concerns, led the AEC to devise a regime to license commercial disposal facilities on land.[29]

Six facilities were built in the 1960s, distributed relatively evenly about the country, and usually sited in close proximity to existing nuclear facilities. These six facilities were located at Beatty, Nevada; Maxey Flats, Kentucky; West Valley, New York; Richland, Washington; Barnwell, South Carolina; and Sheffield, Illinois.[30] Beatty, Maxey Flats, West Valley, and Barnwell were licensed by state authorities under the Agreement State program; Richland and Sheffield were licensed by the

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26. STEWART & STEWART, *supra* note 11, at 259.

27. TASK FORCE ON LOW-LEVEL RADIOACTIVE WASTE DISPOSAL, NAT'L GOVERNORS' ASS'N, LOW-LEVEL WASTE: A PROGRAM FOR ACTION 10–11 (1980).

28. NUCLEAR REGULATORY COMM'N ADVISORY COMM. ON NUCLEAR WASTE, *supra* note 7, at 7.

29. *Id.* As land disposal facilities gradually became available, marine disposal gradually tapered off and was brought to a complete halt by 1970.

30. *Id.* at 10. Beatty is located near the Nevada Test Site, West Valley is located on the grounds of the later-aborted nuclear reprocessing site of the same name, Richland is on the grounds of the Hanford Reservation, and Barnwell is adjacent to the Savannah River Site.

AEC directly.[31] The distinction between AEC regulation and Agreement State regulation is largely academic.

Under the Agreement State program, the AEC could delegate the power to regulate nuclear activities to state agencies if certain regulatory milestones were met, similar to the delegation framework later used for the Clean Air and Clean Water Acts. At the time, no standards for disposal existed, aside from the AEC's generic radiation protection standards, and "there were no systematic site selection criteria or design requirements that could be used to establish the best mix of features necessary to contain and isolate the wastes."[32] As a result, low-level waste was simply dumped into shallow, unlined trenches, and the science of disposal was quite primitive.

B. Youthful Enthusiasm Meets Hard Reality

The primitive disposal sites built during the AEC era, unsurprisingly, ran into severe trouble as the science of disposal advanced. It was soon discovered that the poorly-designed protective trenches at Maxey Flats, West Valley, and Sheffield were all leaking radionuclides.[33] Between 1975 and 1978, all three were shuttered permanently. In 1979, things got worse. In that disastrous year, both Beatty and Richland were temporarily closed after Governor Robert List of Nevada and Governor Dixie Ray of Washington, respectively, discovered that leaky waste containers were arriving at the sites.[34] These accidents left Barnwell as the sole operating low-level waste disposal site available for the entirety of the nation's waste.

South Carolina's governor, Richard Riley, feared that Barnwell would become the permanent host for the nation's low-level waste; even before leakage was discovered at Beatty and Richland, Barnwell was receiving over three-quarters of the nation's low-level waste.[35] As such, Riley announced in 1979 that Barnwell would cut its waste acceptance

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31. *Id.*

32. *Id.* at 9.

33. *Id.* at 11. In the cases of Maxey Flats and Sheffield, radionuclides contaminated the water table. Maxey Flats would later become a Superfund site; as of this writing, remediation is largely complete. West Valley was formally closed in the 1970s. Remediation at West Valley has been ongoing for the last forty years as part of the larger rehabilitation of the West Valley Reprocessing Plant complex. U.S. ENVTL. PROT. AGENCY, RECORD OF SELECTION, REMEDIAL ALTERNATIVE SELECTION: MAXEY FLATS DISPOSAL SITE, FLEMING COUNTY, KENTUCKY 11 (1991); AUDREY THEIR, WEST VALLEY: HISTORY AND FUTURE 1 (2008).

34. Wayne E. Kiefer, *Low-Level Radioactive Waste Issues in Michigan: 1980-2000*, 33 MICH. ACADEMICIAN 343, 351 (2002).

35. Gary W. Hart & Keith R. Glaser, *A Failure to Enact: A Review of Radioactive Waste Issues and Legislation Considered by the Ninety-Sixth Congress*, 32 S.C. L. REV. 639, 774 (1981).

by 50 percent.[36] The states hosting low-level waste disposal facilities were close to open revolt. As the General Accounting Office would later put it, "the Governors of the three States made it clear that they would no longer bear the entire burden of low-level waste disposal—their States would not become the Nation's dumping grounds."[37]

C. The Low-Level Radioactive Waste Policy Act

The lack of disposal standards and poorly designed containment techniques had not gone unnoticed by the Carter Administration. In 1978, the Interagency Review Group on Nuclear Waste Management (IRG) was assembled to create a comprehensive national strategy for dealing with nuclear waste of all kinds.[38] It must be remembered, of course, that precious few standards existed at the time for the disposal of low-level waste beyond the generic radiation protection standards.[39]

The IRG report,[40] which came out in March 1979, recommended that the Energy Department develop a centralized national plan for management of low-level nuclear waste, including the development of new low-level waste disposal facilities. The Energy Department would handle the planning functions for the national low-level waste disposal strategy, while NRC (as well as any Agreement States) would deal with day-to-day operations, licensing, and standards development; even the Energy Department's own facilities would be subject to NRC licensing and regulation.[41]

Notably, the IRG report assumed that the Energy Department would run the development process for new low-level waste disposal sites from Washington D.C., with the concurrence and consent of local and state authorities.[42] Existing low-level waste disposal facilities would be transferred to federal ownership and then be leased back to the disposal site operators.[43] State authorities, already angry with the federal

36. *Id.* at 775-77.

37. U.S. GEN. ACCOUNTING OFFICE, *supra* note 15, at 7.

38. STEWART & STEWART, *supra* note 11, at 147. The scope of this paper is limited to the aspects of the IRG report relating to low level waste.

39. Complete NRC standards for the packaging, transportation, and ultimate storage of low-level waste would not be issued until 1983, twenty-plus years after disposal operations had already begun at Maxey Flats and Beatty. L. David Condon, *The Never-Ending Story: Low-Level Waste and the Exclusionary Authority of Noncompacting States,* 30 NAT. RESOURCES J. 65, 67 n.10 (1990).

40. INTERAGENCY REVIEW GRP. ON NUCLEAR WASTE MGMT., REPORT TO THE PRESIDENT 106 (1979) [hereinafter IRG REPORT].

41. *Id.* at H-7–H-8.

42. *Id.* at 108-09.

43. *Id.* at 124. This "leaseback" setup is the current arrangement at Richland.

government's perceived inability to regulate low-level waste, were not thrilled with IRG's plan.[44]

The National Governors Association drew up a counterproposal in 1980 in opposition to the IRG's recommendations.[45] The National Governors Association plan treated low-level waste as a regional issue rather than a national issue, and created an alternative proposal, devolving the responsibility to the states to provide for disposal of low-level waste.[46] Under this proposal, states could come together in voluntary associations, known as "compacts," to share waste disposal facilities and exclude waste from states outside their compact after January 1, 1986.[47] Six super-regional compacts were proposed, integrating the three then-existing facilities (Beatty, Richland and Barnwell) into the proposed Southwest, Northwest, and Southeast compacts, respectively. The federal government would only be responsible for approving compacts, and for dealing with low-level waste associated with the Department of Energy, Navy vessel decommissioning, the nuclear weapons program, and waste greater than Class C. All proposed low-level radioactive waste compacts, however, would have to be explicitly approved by Act of Congress—a requirement that would later prove fatal to the entire compact project. Facilities would have to be sited following NRC guidelines—disposal standards, geological safety requirements, and monitoring requirements—but all other decisions were left to the states. As a result of the 1980 lame-duck legislative session, Congress decided to adopt the National Governors Association's approach rather than the centralized form recommended by the IRG.[48]

D. Five Years of Gridlock

In its initial form, the LLRWPA led to more gridlock. As early as 1983, it was clear it was impossible for the compacts to meet the congressional deadline for new low-level waste disposal facilities.[49] The new system was sorely tried during these years—simply put, the states were very bad at organizing themselves into compacts. Washington, Nevada, and South Carolina quickly joined with neighboring states, but

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44. State governors, as represented by the National Governors Association, demanded veto power over site selection. *Id.* at H-14; *see also* MARY R. ENGLISH, SITING LOW-LEVEL RADIOACTIVE WASTE DISPOSAL FACILITIES: THE PUBLIC POLICY DILEMMA 7 (1992).

45. TASK FORCE ON LOW-LEVEL RADIOACTIVE WASTE DISPOSAL, *supra* note 27, at 1.

46. *Id.* at 10-11.

47. Low Level Radioactive Waste Policy Act of 1980, 42 U.S.C. § 2021d(a)(2)(B) (2013).

48. New York v. United States, 505 U.S. 144, 150 (1992); *see also* TASK FORCE ON LOW-LEVEL RADIOACTIVE WASTE DISPOSAL, *supra* note 27, at 6; *cf.* 42 U.S.C. § 2021b.

49. U.S. GEN. ACCOUNTING OFFICE, *supra* note 15, at 15.

attempts to secure congressional approval for these three states' respective compacts were blocked by the states without low-level waste disposal sites of their own.[50] By 1985, no compact had yet gained Congressional approval, as states without active disposal sites were loath to permit the three existing compact sites to close to outside waste.[51] Nor had any state or compact built a disposal facility. With the January 1, 1986, deadline looming, and no resolution in sight, Washington, Nevada, and South Carolina started threatening to close their facilities to low-level waste entirely.[52] With twelve days to go before the cutoff, Congress hammered out a compromise sponsored by the National Governors Association known as the "Low-Level Radioactive Waste Policy Amendments Act of 1985."[53] These amendments will be referred to as the 1985 Amendments.[54]

E. Seven Years of Chaos

The 1985 Amendments added teeth to the LLRWPA, establishing a two-part system of positive and negative incentives to encourage the states to join compacts and build new disposal facilities.

First, the federal government would give financial incentives or penalties as a result of compliance or non-compliance. If a state or compact managed to meet its deadlines and establish a disposal facility on time, the federal government would give financial bonuses to that state or compact.[55] If a state or compact failed to meet the various deadlines, various forms of financial penalties would be incurred.[56] The most important of these was the prospect of further facility closures. Per the statute, Barnwell, Beatty and Richland could close themselves to outside waste after January 1, 1993.

Second, and more troublesome, if a state did not comply with its obligations to have a disposal facility to utilize by January 1, 1993, that state would have to take title to all low-level waste generated within the state, or else pay for the owners or generators' storage costs.[57] After January 1, 1996, the state would have to take title to the waste,

50. Condon, *supra* note 39, at 69, 71.

51. Chuang, *supra* note 10, at 2435.

52. Condon, *supra* note 39, at 71.

53. Chuang, *supra* note 10, at 2435.

54. Low-Level Radioactive Waste Policy Amendments Act of 1985, Pub. L. No. 99-240, § 5(a)-(b), 99 Stat. 1842, 1846-47 (1986) (codified as amended at 42 U.S.C. § 2021e).

55. 42 U.S.C. § 2021e(d)(2)(A).

56. *Id.* § 2021e(d)(1) (adding a surcharge to low-level waste originating in compacts or states without disposal arrangements).

57. *Id.* § 2021e(d)(2)(A).

regardless.[58] It was this last provision, the "take-title" provision, which provided the most powerful incentive for the states and compacts without disposal facilities because of the potentially unlimited liability.[59]

In the end, even these incentives and penalties proved insufficient in the face of determined local and state opposition, as one thing or another always seemed to derail the proposed waste facilities. Between the 1985 Amendments and the 1993 deadline, there was only one facility that opened during this period, the Class A-only site located in Clive, Utah, which was constructed outside the compact process.[60]

Other than the opening of Clive, every other proposed facility met with disaster in one way or another. In California, the proposed Ward Valley facility missed the 1993 deadline because of an Endangered Species Act suit filed on behalf of the endangered desert tortoise.[61] After a decade of litigation, California and the Southwestern Compact abandoned its attempts to build the facility in 2002.[62] Michigan's state legislature agreed to build a low-level waste disposal facility for the Midwest Compact, then proceeded to pass an authorization bill purposely designed to stall site selection indefinitely. As a result, the Midwest Compact kicked Michigan out for bad faith.[63]

Perhaps the most amusing failure was that of Nebraska, where the State of Nebraska and the Central Compact attempted to build a facility in remote Boyd County, in the town of Butte, population 366.[64] Butte was just another small, dying Midwestern village in a county full of small, dying Midwestern villages, and in Boyd County, the competition for jobs between those villages was positively Darwinian. Here, Butte volunteered itself for consideration as a potential disposal site for the Nebraska and the Central Compact, buoyed by the promise of $3 million per year in community development funding that the low-level waste disposal site brought with it.[65] This amounts to the non-paltry figure of

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58. *Id.* § 2021e(d)(2)(C).

59. Under common-law tort, low-level radioactive waste is an uncommonly dangerous substance, so the states would assume liability for any damages caused by the waste.

60. *See* Chuang, *supra* note 10, at 2454. The compact system requires siting decisions to be made by compact state representatives in addition to government financing. The Clive site was privately financed, and the siting decision made by the investors in conjunction with the state of Utah.

61. U.S. Ecology v. Dep't of the Interior, 231 F.3d 20, 23 (D.C. Cir. 2000) (citing Desert Tortoise v. Lujan, No. 93-0114 (N.D.Cal. Jan. 8, 1993) (order granting temporary restraining order)).

62. 2002 Cal. Legis. Serv. Ch. 513 § 4 (A.B. 2214) (West) (codified at CAL. HEALTH & SAFETY CODE § 115261)).

63. *See* Kiefer, *supra* note 34, at 358; MICH. COMP. LAWS §§ 333.26201-333.26226 (2013).

64. SUSAN CRAGIN, NUCLEAR NEBRASKA: THE REMARKABLE STORY OF THE LITTLE COUNTY THAT COULDN'T BE BOUGHT 38 (2007).

65. *Id*.

$8,000 per year, give or take a few dollars, worth of infrastructure funding for every man, woman, and child in the village of Butte.

The other Boyd County villages were not particularly happy with this state of affairs—partially because of "Not In My Back Yard" syndrome, but mostly because of jealousy—and successfully marshaled Democratic Party officials against the disposal site.[66] Due to this growing discontent, Republican Governor Kay Orr, who supported the Butte facility, faced a difficult re-election battle against her Democratic challenger, Ben Nelson. Nelson used Orr's support for the proposed Butte facility against her to great effect, and narrowly defeated Orr in the 1990 gubernatorial election.[67] As governor, Nelson used impermissible political grounds to prevent the facility from being licensed, leading to a successful lawsuit by the Central Compact against Nebraska and a damage award of $151 million.[68]

Of course, not all states made efforts to develop disposal sites or join compacts. Some, such as New York, turned to the one quintessentially American pastime: litigation.

F. Twenty Years of Uncertainty

New York never joined a compact, preferring to build a low-level waste disposal facility first and find compact partners second. Five sites were identified by state regulators: two in Cortland County, located thirty miles south of Syracuse, and three in Allegany County, seventy-five miles southwest of Buffalo as the crow flies.[69] While site selection was ongoing, the two potential host counties and the state attorney general's office filed suit in 1990, seeking to have the penalties created by the 1985 Amendments—both financial and take-title—declared unconstitutional under the Guarantee Clause of Article IV, as well as the Fifth, Tenth and Eleventh Amendments.[70] In the space of two years, the New York suit lost motions to dismiss on all counts at both the district court level,[71] and on appeal to the Second Circuit.[72] New York appealed its Guarantee Clause and Tenth Amendment claims to the Supreme Court. The Supreme Court granted certiorari.

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66. STEWART & STEWART, *supra* note 11, at 153-54.

67. CRAGIN, *supra* note 64, at 131.

68. Entergy Arkansas, Inc. v. Nebraska, 226 F.Supp.2d 1047, 1102–04, 1140–42 (D. Neb. 2002), *aff'd*, 358 F.3d 528 (8th Cir. 2004). Boyd County, Nebraska, continues to decline; since the 1990 census, its population has dropped by over 25 percent.

69. New York v. United States, 505 U.S. 144, 154 (1992).

70. *Id.* at 152-54.

71. New York v. United States, 757 F.Supp.2d 10 (N.D.N.Y. 1990).

72. New York v. United States, 942 F.2d 114 (2d Cir. 1991).

In a landmark 1992 decision, the Supreme Court held that the take-title provisions of the 1985 Amendments violated the Tenth Amendment by improperly coercing the states to do the bidding of Congress, but the Court let the financial incentives stand.[73] The Court's majority seemed strangely unwilling to accept the fact that the LLRWPA and the 1985 Amendments were passed at the behest of state authorities rather than in defiance of them—a fact that the legislative history makes clear[74] and Justice White's dissent points out.[75]

The Court's decision put the final nail in the coffin of the LLRWPA, by removing the most powerful incentive for state compliance—the threat of unlimited liability from low-level radioactive waste. As might be expected, support for new disposal facilities petered out after the *New York* decision, leaving Utah and South Carolina as the only active low-level waste disposal sites outside the Northwest Compact—Richland was closed to out-of-compact waste at the 1993 cutoff, and Beatty shut down entirely at the Nevada governor's executive order in 1992.[76]

Thus, for twenty years, most of the country's ability to dispose of Class B and C low-level waste was dependent on the whims of South Carolina and Utah regulators. Disposal fees at Barnwell, the sole site open for Class B and C waste, went up by 650 percent between 1992 and 2003.[77] (As noted previously, Clive only accepted Class A waste, per the terms of its license, but can accept waste from any source, as it exists outside the compact system.) South Carolina regulators actually closed Barnwell to out-of-compact waste between 1994 and 1995,[78] when South Carolina was part of the Southeast Compact, and again after 2008, when capacity issues led the state to close Barnwell to waste originating outside of the Atlantic Compact.[79] During Barnwell's periods of closure to outside waste, waste generators without access to a disposal site had to store their Class B and C waste on-site, an expensive and difficult undertaking. One university was forced to spend $12 million for a low-level waste disposal facility of its own.[80]

This constant insecurity, especially with regard to Class B and C waste, was not all bad: as disposal costs increased, waste volume

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73. *New York*, 505 U.S. at 176.

74. *See supra* Parts II-C, II-E.

75. *New York*, 505 U.S. at 195-197 (White, J., dissenting).

76. STEWART & STEWART, *supra* note 11, at 154.

77. *Id.*

78. S.C. DEP'T. OF HEALTH & ENVTL. CONTROL, *supra* note 5, at 1.

79. STEWART & STEWART, *supra* note 11, at 154.

80. *Id.* at 158; U.S. GOV'T ACCOUNTABILITY OFFICE, LOW-LEVEL RADIOACTIVE WASTE: STATUS OF DISPOSAL AVAILABILITY IN THE UNITED STATES AND OTHER COUNTRIES 5 (2008).

reduction techniques flourished, as generators developed innovative ways to reduce waste volumes through shredding, incineration, and compaction, among other things.[81] Waste generators also took steps to reduce the amount of equipment exposed to harmful radioactivity.

The twenty-year run of failure since the *New York* decision, combined with the intermittent availability of Barnwell for Class B and C waste, led to opportunities for states willing to cynically exploit the compact system: of the ten currently existing compacts, five are noncontiguous; of these, three (the Atlantic, Southwestern, and Texas compacts) are the products of gerrymandering.

The Atlantic Compact originally included only New Jersey and Connecticut, but this changed when South Carolina legislators sought to close Barnwell to out-of-state waste in 2000. South Carolina went compact shopping, eventually deciding on the Atlantic Compact so as to gain control over waste inputs at Barnwell. Between 1995 and 2000, South Carolina was unaffiliated with any compact, and accepted waste from any state except North Carolina.[82]

Similarly, the Southwestern Compact counts California, Arizona, and the Dakotas as members. At the time of the compact's creation, California, a major waste producer, was making serious efforts to build a facility in the Mojave Desert to avert the negative incentives of the 1985 Amendments. California agreed to include North and South Dakota in the Southwestern Compact, in exchange for construction funds.[83]

The Texas Compact provides the third illustration of this phenomenon, and demonstrates how the LLRWPA system can be exploited to its fullest. Ironically, this cynical approach to low-level waste disposal led to the construction of the only new regional disposal facility to be developed under the compact system. In 2003, Texas identified a site in isolated Andrews County, near the New Mexico border, and began the long process of licensing and construction for the new Andrews facility.[84] With the political will and local support to build a new low-level waste disposal site in place, Texas began to seek out a compact "partner." Texas placed onerous conditions on membership in the Texas Compact: Texas appointees would hold a supermajority over

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81. NUCLEAR REGULATORY COMM'N ADVISORY COMM. ON NUCLEAR WASTE, *supra* note 7, at 2; STEWART & STEWART, *supra* note 11, at 158.

82. After North Carolina was unable to build a facility for the Southeast Compact, South Carolina withdrew from the compact in protest, and excluded North Carolina waste from Barnwell, even though South Carolina was not a member of any compact at the time. This was, of course, in blatant defiance of the LLRWPA. S.C. DEP'T. OF HEALTH & ENVTL. CONTROL, *supra* note 5, at 3.

83. STEWART & STEWART, *supra* note 11, at 151.

84. NUCLEAR REGULATORY COMM'N ADVISORY COMM. ON NUCLEAR WASTE, *supra* note 7, at 26.

the compact commission and the other state would have to put down $25 million in construction costs for the Andrews facility. States with large populations and states that generated large amounts of waste were excluded from possible membership.[85] In short, every possible step was taken to ensure that Texas retained complete control over its compact—Texas wanted to have its cake and eat it too.

Texas also did an excellent job deciding on a host community: Andrews is located in the Permian Basin, an area home to a wide variety of nuclear facilities, including the Waste Isolation Pilot Project. Most of the heavy local opposition of the type encountered in Nebraska and New York was thus avoided.

The Texas Commission on Environmental Quality issued a license for Andrews to operate in 2009, clearing the way for construction to commence, and the facility opened in 2012.[86] Andrews currently accepts Class A, B, and C low-level waste from all sources, per a determination by the Texas Compact Commission; however, this is subject to change at any time, due to Texas' control of the Compact Commission.[87]

III. CURRENT STATE OF THE LOW-LEVEL WASTE COMPACT SYSTEM

As it stands now, there are four low-level radioactive waste disposal facilities presently operating in the United States. Richland and Barnwell accept all classes of commercial low-level waste and act as the regional disposal facilities for the Northwest and Atlantic compacts, respectively. Both date back to the AEC era, and neither accepts out-of-compact waste. Clive accepts Class A waste from all sources, and currently exists outside the compact system.. Litigation is ongoing as the Northwest Compact attempts to exert jurisdiction over Clive.[88] Clive was constructed as a private venture; as of 2005, Clive handled 99 percent of all Class A radioactive waste generated in the United States.[89] Finally, Andrews, the newest of the four facilities, accepts all classes of waste from all sources, and serves as the regional disposal facility for the Texas Compact.

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85. STEWART & STEWART, *supra* note 11, at 151.

86. TEXAS COMM'N ON ENVTL. QUALITY, RADIOACTIVE MATERIAL LICENSE NO. R04100 (2009).

87. *See* Jim Vertuno, *Texas Officials Approve Radioactive Waste Dump*, BOSTON.COM (March 23, 2012), http://www.boston.com/news/local/vermont/articles/2012/03/23/texas_officials_approve_radioactive_waste_dump/.

88. EnergySolutions, LLC v. Utah, 625 F.3d 1261 (10th Cir. 2010).

89. U.S. GOV'T ACCOUNTABILITY OFFICE, LOW-LEVEL RADIOACTIVE WASTE MANAGEMENT: APPROACHES USED BY FOREIGN COUNTRIES MAY PROVIDE USEFUL LESSONS FOR MANAGING U.S. RADIOACTIVE WASTE 70 (2007). It must be noted, of course, that these figures predate two critical occurrences: first, the closure of Barnwell to non-compact waste, and second, the 10th Circuit decision confirming the Northwest Compact's jurisdiction over Clive.

After Andrews' opening, physical capacity is no longer an issue for the short term. Richland and Barnwell have sufficient capacity to handle all their respective compacts' waste needs until, at least, 2050.[90] The outlook for the other thirty-six states is no longer as dire as it was even one year ago because both Clive and Andrews are currently open to receive waste. Given projected waste volumes, Clive has adequate capacity under its license to handle nearly the entirety of the nation's Class A waste until 2040, even without expansion.[91] Andrews, of course, is brand-new, and is licensed to operate through 2024, with adequate capacity to import large quantities of waste.[92] Andrews should be able to handle up to 1 million cubic feet of imported low-level waste through 2024.[93]

The largest threat to the continued availability of low-level waste disposal facilities is now political rather than physical. Under the current compact arrangements, Texas and Utah have near-complete power over the nation's low-level waste disposal system, and will continue to do so unless major regulatory changes occur in the system for regulating low-level waste disposal sites. If the Utah or Texas state governments, or their associated compacts, start having second thoughts about importing waste, like what has happened already with South Carolina, Washington, and Nevada, the entire national system for low-level waste disposal could be upended once again. Even now, the Northwest Compact is attempting to veto the importation of certain waste into the Clive facility, which can import waste from anywhere. In 2010, the 10th Circuit Court of Appeals ruled in favor of the Northwest Compact's regulatory jurisdiction, even though the Clive facility is not actually a regional disposal facility as defined by the LLRWPA.[94] This does not bode well for the future, given how rapidly the Northwest Compact closed Richland to outside waste in the 1990s.

IV. WHAT IS TO BE DONE?

The states' commercial low-level waste disposal needs are met for now. But the present should not, and cannot, be the basis of a viable long-term solution. Simply put, the LLRWPA is fragile and vulnerable to disruption—in short, it is a house built on sand.[95] The last thirty-plus

90. U.S. GOV'T ACCOUNTABILITY OFFICE, *supra* note 80, at 5.

91. *Id.*

92. TEXAS LOW-LEVEL RADIOACTIVE WASTE DISPOSAL COMPACT COMM'N, WCS COMPACT WASTE FACILITY DISPOSAL CAPACITY REPORT 5 (2012).

93. *Id.* at 12.

94. EnergySolutions, LLC v Utah, 625 F.3d 1261, 1265 (10th Cir. 2010).

95. "And every one that heareth these sayings of mine, and doeth them not, shall be likened unto a foolish man, which built his house upon the sand: And the rain descended, and the floods

years have been a fiasco for low-level waste disposal because the states are just so bad at managing low-level waste on their own. As has been shown, the compact system encourages bad behavior by the states. The examples referenced, like the gerrymandering of the Texas Compact, the petty battles between North and South Carolina over who would bear responsibility for Southeast Compact waste, and Nebraska Governor Nelson's favor to the NIMBYs of Boyd County, Nebraska, are just the tip of the iceberg. The whole affair would be comical, were a subject of national concern not at stake. The reasons for reform are legion.

Fundamentally, the LLRWPA misidentified what the actual problem *was*. In creating the compact system, Congress believed that the problem with low-level waste regulation was that the federal government was just not very good at it and that state regulators, given the chance, would be able to handle the problem better. Congress simply misidentified the problem. The problems that had beset low-level waste disposal sites up to that time were technological, not the results of flaws in the regulatory structure itself. One must not forget that no scientific standards existed for the disposal of low-level radioactive waste between 1962, when Beatty opened, and 1983, when NRC finalized rules for low-level waste disposal. At present, of course, the science of disposal is much better understood, but changes in the regulatory structure have made it impossible to handle commercial low-level waste in a sane manner.

A. A Modest Proposal: Energy Department Integration

In the midst of the chaos surrounding the commercial low-level waste disposal system, the Energy Department's parallel system for handling low-level waste has plodded along quietly and competently, with none of the drama, backstabbing, and hyperbole associated with the commercial low-level waste disposal system.[96] It would be possible, as well as legal, for the Energy Department to accept commercial waste into its own disposal system once again, as the AEC once did between 1959 and 1963.[97] As of 2004, the Energy Department had ample capacity in its own low-level waste disposal sites in Nevada and Washington, and could

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came, and the winds blew, and beat upon that house; and it fell: and great was the fall of it." *Matthew* 7:26-27 (King James).

96. As noted the Department of Energy is responsible for Department of Energy waste, waste from Navy vessel decommissioning, and waste from the national nuclear weapons program, as well as waste greater than Class C.

97. Kiefer, *supra* note 34, at 346.

accept compact waste on a contract basis.[98] (Class B and C waste, obviously, would be preferable, because multiple alternate options are available for Class A waste at the moment.)

This option would keep the states honest: with Energy Department facilities available as a backstop, threats to close a compact facility, as what happened at Barnwell, Richland, and Beatty, would have far less potency. There are, of course, risks involved in opening Energy Department facilities on an ad-hoc basis. The most obvious one is that states might begin to rely on the Energy Department for day-to-day disposal, for instance, rather than using Energy Department facilities as waste disposers of last resort, but this problem is easily cured by charging high access fees.

B. A Slightly Less Modest Proposal: Refederalization

The other alternative, of course, is to scrap the entire compact system and return to the pre-1980 model, where NRC managed commercial low-level waste at a national level, subject to devolution to Agreement States where appropriate. This would solve the disposal crisis permanently, and eliminate the danger of state recalcitrance (as exhibited by South Carolina towards North Carolina) by treating low-level radioactive waste at the national level again, just as it was in 1980, permitting the full force of federal power to deal with the NIMBY problem.

Of course, this plan would require Congressional approval—and has a snowball's chance in hell of passing Congress.

V. CONCLUSION

In 1980, the federal government was doing a sub-par job of regulating low-level radioactive waste, and the states wanted that bad management to come to an end. The problem, the states identified was the choice of regulator, rather than a lack of technical knowledge on the subject of low-level radioactive waste disposal. The states successfully lobbied Congress to devolve regulatory authority, thinking that they would be able to competently manage low-level radioactive waste at the regional, rather than the national level. Simply put, the states were wrong.

The Low-Level Radioactive Waste Policy Act, the states' hand-crafted plan, was a disaster from the beginning. For over thirty years, the

98. U.S. GOV'T ACCOUNTABILITY OFFICE, LOW-LEVEL RADIOACTIVE WASTE: DISPOSAL AVAILABILITY ADEQUATE IN THE SHORT TERM, BUT OVERSIGHT NEEDED TO IDENTIFY ANY FUTURE SHORTFALLS 42 (2004).

compact system has produced drama worthy of a high school soap opera, as the states plotted, schemed, and squabbled, over ways to make some other jurisdiction handle their radioactive waste. Without the federal government there to check the states' worst desires, and with the Supreme Court declaring the only useful incentive from the 1985 Amendments unconstitutional, the only things left over were drama, gridlock, and uncertainty.

For these reasons, it is time for the federal government to reassert its role in low-level radioactive waste disposal: first, by permitting the Energy Department to provide a backstop if state disposal sites become unavailable; and second, by repealing the Low-Level Radioactive Waste Policy Act.

APPENDIX A: CURRENT & PAST LOW-LEVEL RADIOACTIVE WASTE DISPOSAL SITES

Site	*Date operational*	*Date closed*	*Status*	*Waste classes*	*Compact*	*Accepts out-of-compact waste?*
Beatty, NV	1962	1992	Closed	ABC	Rocky Mountain	n/a
Maxey Flats, KY	1963	1977	Closed	n/a[99]	n/a	-
West Valley, NY	1963	1975	Closed	n/a[100]	n/a	-
Richland, WA	1965	-	Open	ABC	Northwest	No
Barnwell, SC	1969	-	Open	ABC	Atlantic	No
Sheffield, IL	1968	1978	Closed	n/a[101]	-	-
Clive, UT	1991	-	Open	A	TBD[102]	Yes
Andrews, TX	2012	-	Open	ABC	Texas	Yes

99. Waste classes were not created until 1983.
100. Waste classes were not created until 1983.
101. Waste classes were not created until 1983.
102. Clive exists outside the compact system, but litigation between Clive's operator, the Northwest Compact, and Utah is ongoing.

APPENDIX B1: 1980 NATIONAL GOVERNORS ASSOCIATION PROPOSED LOW-LEVEL RADIOACTIVE WASTE COMPACTS[103]

Compact	*States*	*Regional disposal facility*
Midwest	Illinois, Indiana, Iowa, Ohio, Michigan, Minnesota, Wisconsin	-
Northeast	Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont	-
Northwest	Alaska, Idaho, Montana, Oregon, Washington, Wyoming	Richland, WA
South Central	Arkansas, Louisiana, Missouri, Mississippi, Texas	-
Southeast	Alabama, Florida, Georgia, North Carolina, South Carolina, Tennessee	Barnwell, SC
Southwest	Arizona, California, Colorado, New Mexico, Nevada, Utah	Beatty, NV
Multiple possibilities	Delaware, Hawaii, Kansas, Kentucky, Maryland, Nebraska, North Dakota, Oklahoma, South Dakota, Virginia, Washington DC, West Virginia	

103. TASK FORCE ON LOW-LEVEL RADIOACTIVE WASTE DISPOSAL, *supra* note 27, at 10-11.

APPENDIX B2:CURRENT LOW-LEVEL RADIOACTIVE WASTE COMPACTS (2013) [104]

Compact	*States*	*Regional disposal facility*
Appalachian	Delaware, Maryland, Pennsylvania, West Virginia	-
Atlantic	Connecticut, New Jersey, South Carolina	Barnwell, SC
Central	Arkansas, Louisiana, Oklahoma, Kansas	-
Central Midwest	Illinois, Kentucky	-
Midwest	Indiana, Iowa, Minnesota, Missouri, Ohio, Wisconsin	-
Northwest	Alaska, Hawaii, Idaho, Montana, Oregon, Utah, Washington, Wyoming	Richland, WA Clive, UT[105]
Rocky Mountain	Colorado, Nevada, New Mexico	Richland, WA[106]
Southeast	Alabama, Florida, Georgia, Mississippi, Tennessee, Virginia	-

104. Taken from NRC's website. *Low-Level Waste Compacts*, U.S. NUCLEAR REGULATORY COMM'N, http://www.nrc.gov/waste/llw-disposal/licensing/compacts.html (last visited Apr. 23, 2013).

105. Regulated under Utah state law rather than by the Northwest Compact. Accepts Class A waste from all fifty states.

106. Sends waste to Richland under a contract with the Northwest Compact.

Southwestern	Arizona, California,[107] North Dakota, South Dakota	-
Texas	Texas, Vermont	Andrews, TX[108]
Unaffiliated/ no compact	Maine, Michigan,[109] Nebraska,[110] New Hampshire, New York, North Carolina,[111] Puerto Rico, Rhode Island, Washington D.C.	-

107. Ward Valley LLW site is fully permitted, but facility was cancelled in 2002.
108. Accepts waste from all fifty states, pursuant to a determination of the Texas Legislature.
109. Ejected from Midwest Compact after failing to build disposal site.
110. Ejected from Central Compact after failing to build disposal site.
111. Withdrew from Southeast Compact after being selected to host disposal site.